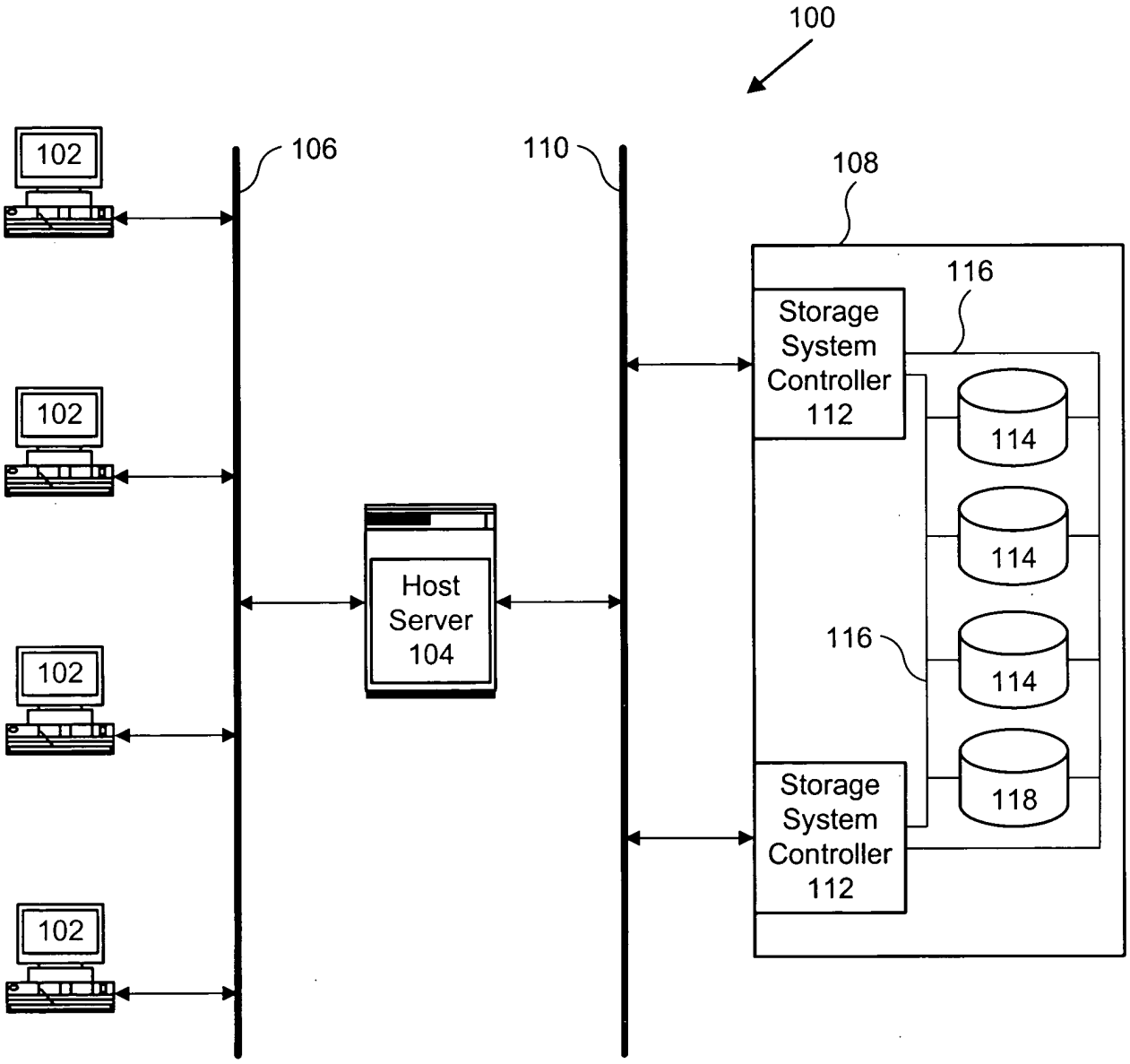
100
102
106
110
108
116
Storage System Controller 112
114
Host Server 104
116
Storage System Controller 112
118

FIG. 1

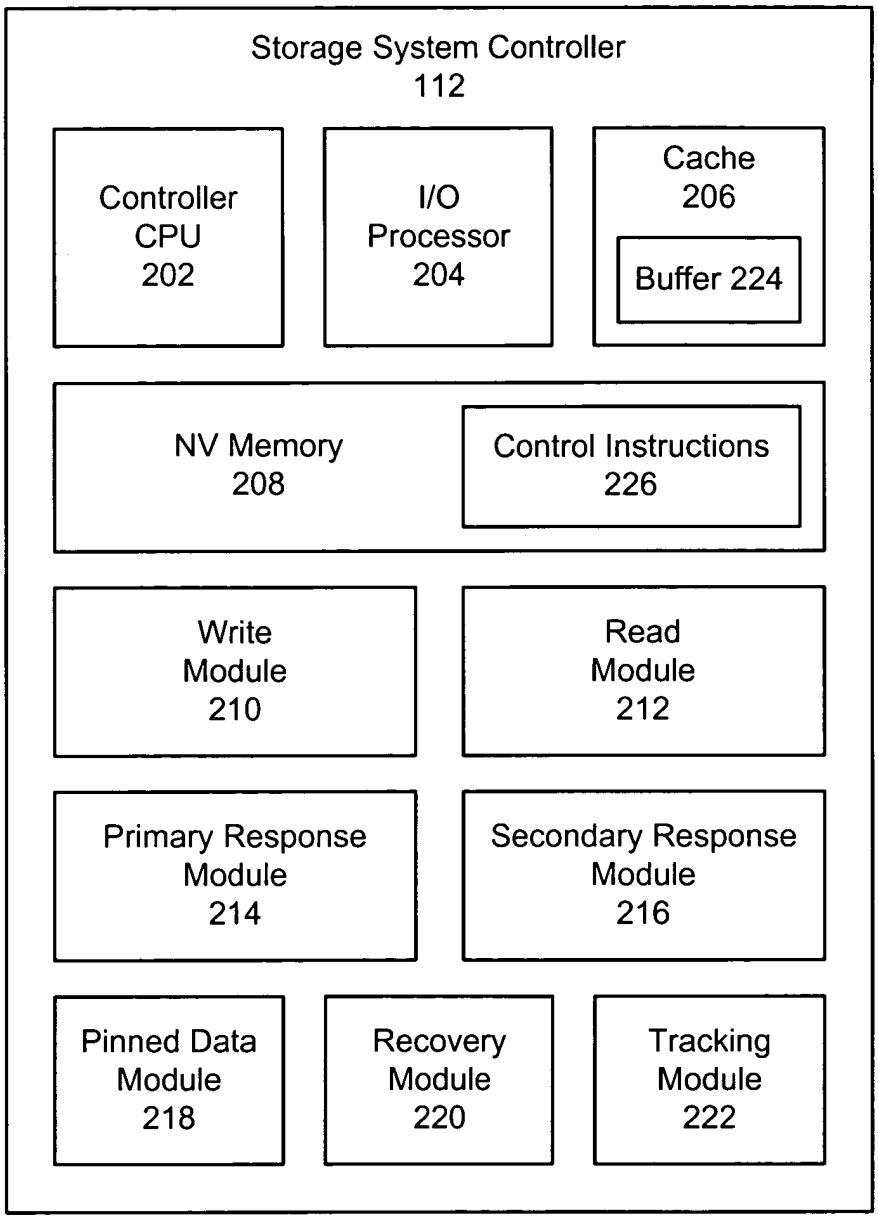
Storage System Controller
112
Controller
CPU
202
I/O
Processor
204
Cache
206
Buffer 224
NV Memory
208
Control Instructions
226
Write
Module
210
Read
Module
212
Primary Response
Module
214
Secondary Response
Module
216
Pinned Data
Module
218
Recovery
Module
220
Tracking
Module
222

FIG. 2

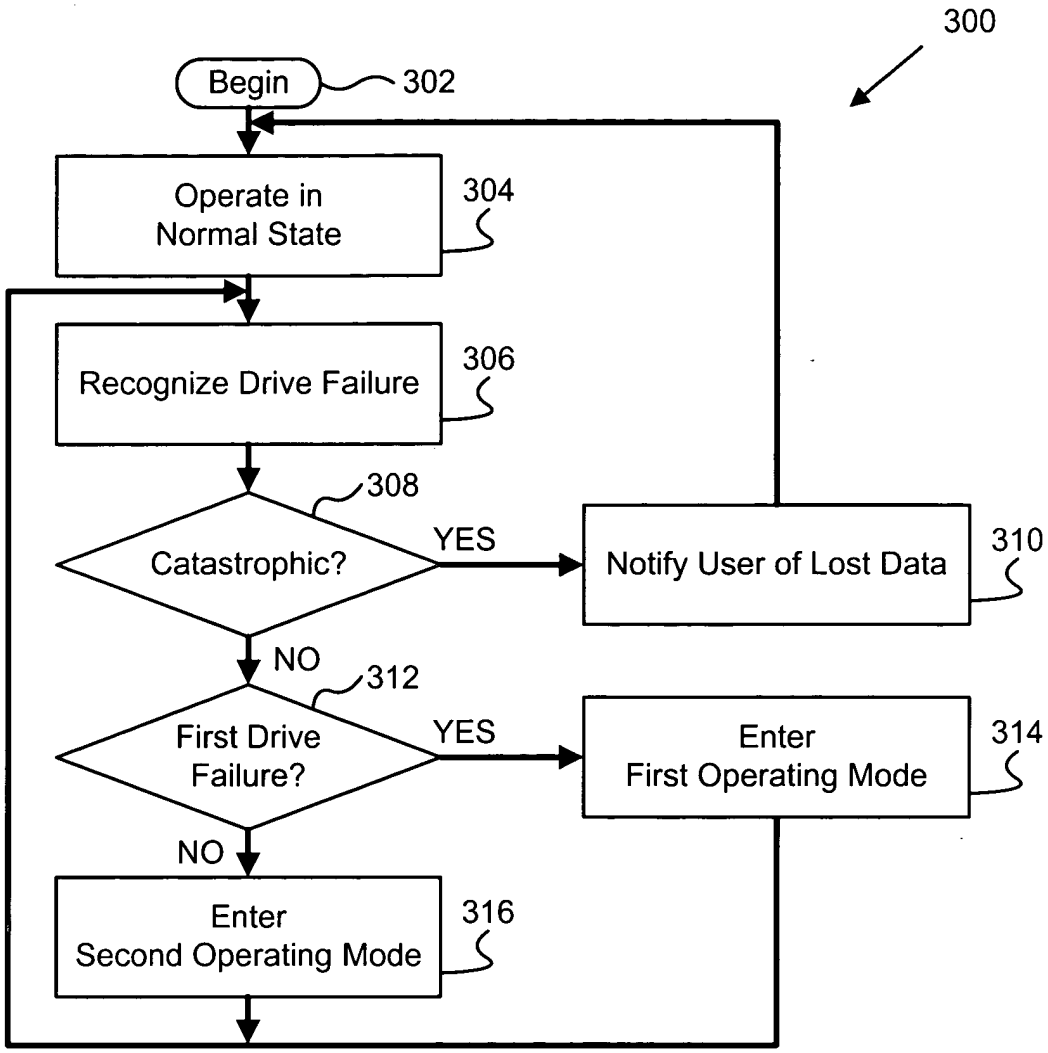
300
Begin
302
Operate in Normal State
304
Recognize Drive Failure
306
308
Catastrophic?
YES
Notify User of Lost Data
310
NO
312
First Drive Failure?
YES
Enter First Operating Mode
314
NO
Enter Second Operating Mode
316

FIG. 3

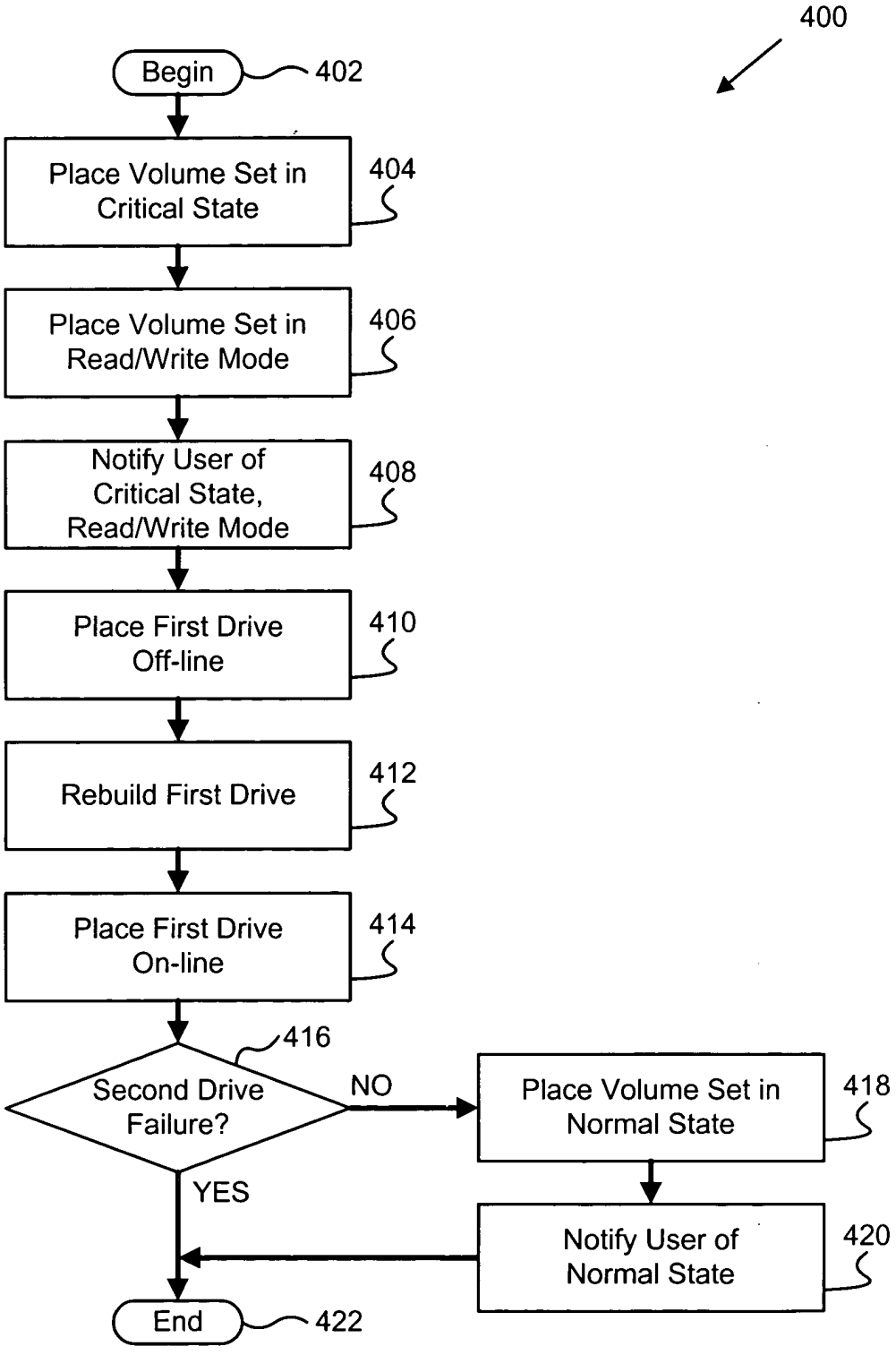
400
Begin
402
Place Volume Set in Critical State
404
Place Volume Set in Read/Write Mode
406
Notify User of Critical State, Read/Write Mode
408
Place First Drive Off-line
410
Rebuild First Drive
412
Place First Drive On-line
414
416
Second Drive Failure?
NO
Place Volume Set in Normal State
418
YES
Notify User of Normal State
420
End
422

FIG. 4

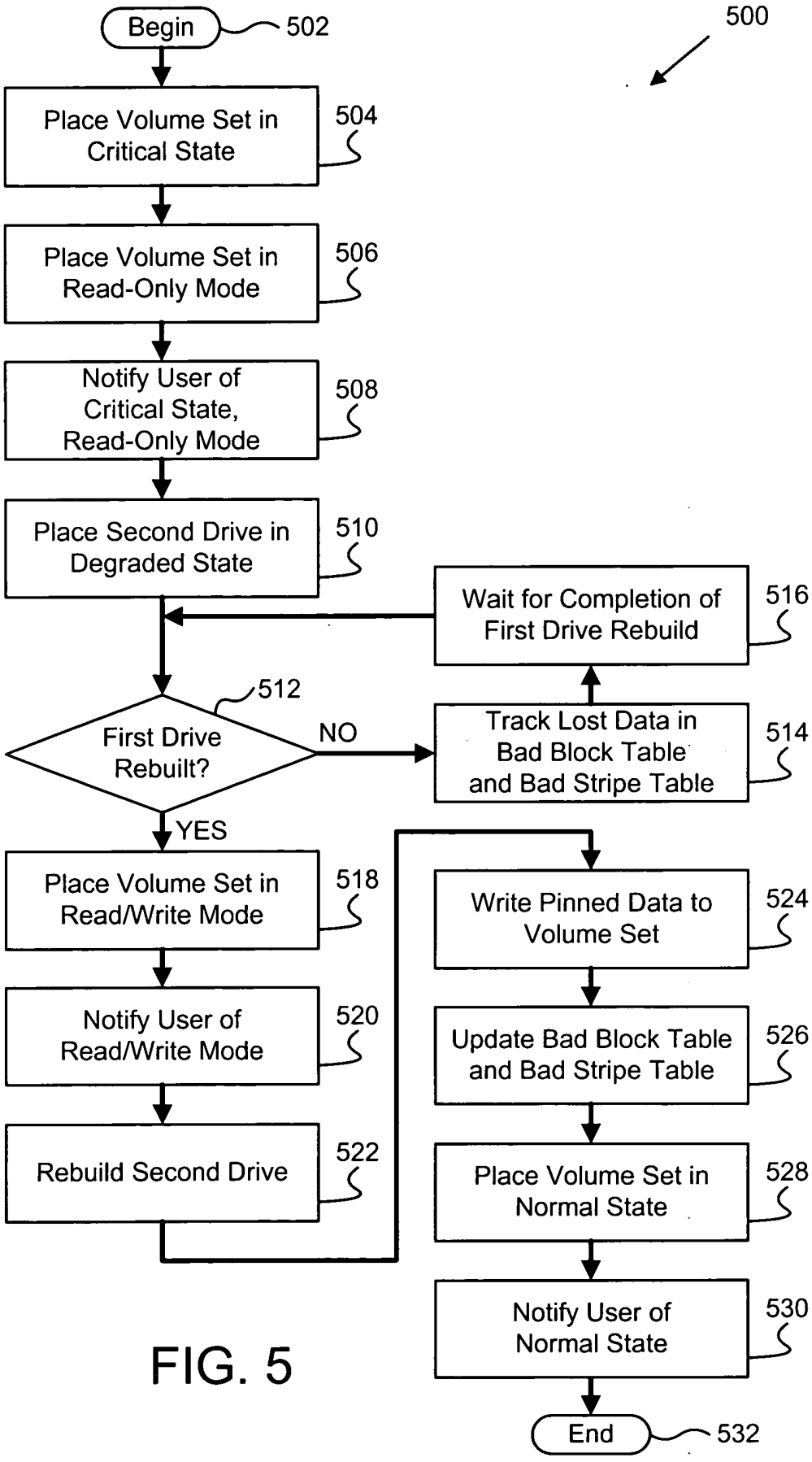
500
Begin
502
Place Volume Set in Critical State
504
Place Volume Set in Read-Only Mode
506
Notify User of Critical State, Read-Only Mode
508
Place Second Drive in Degraded State
510
Wait for Completion of First Drive Rebuild
516
First Drive Rebuilt?
512
NO
Track Lost Data in Bad Block Table and Bad Stripe Table
514
YES
Place Volume Set in Read/Write Mode
518
Notify User of Read/Write Mode
520
Rebuild Second Drive
522
Write Pinned Data to Volume Set
524
Update Bad Block Table and Bad Stripe Table
526
Place Volume Set in Normal State
528
Notify User of Normal State
530
End
532

FIG. 5

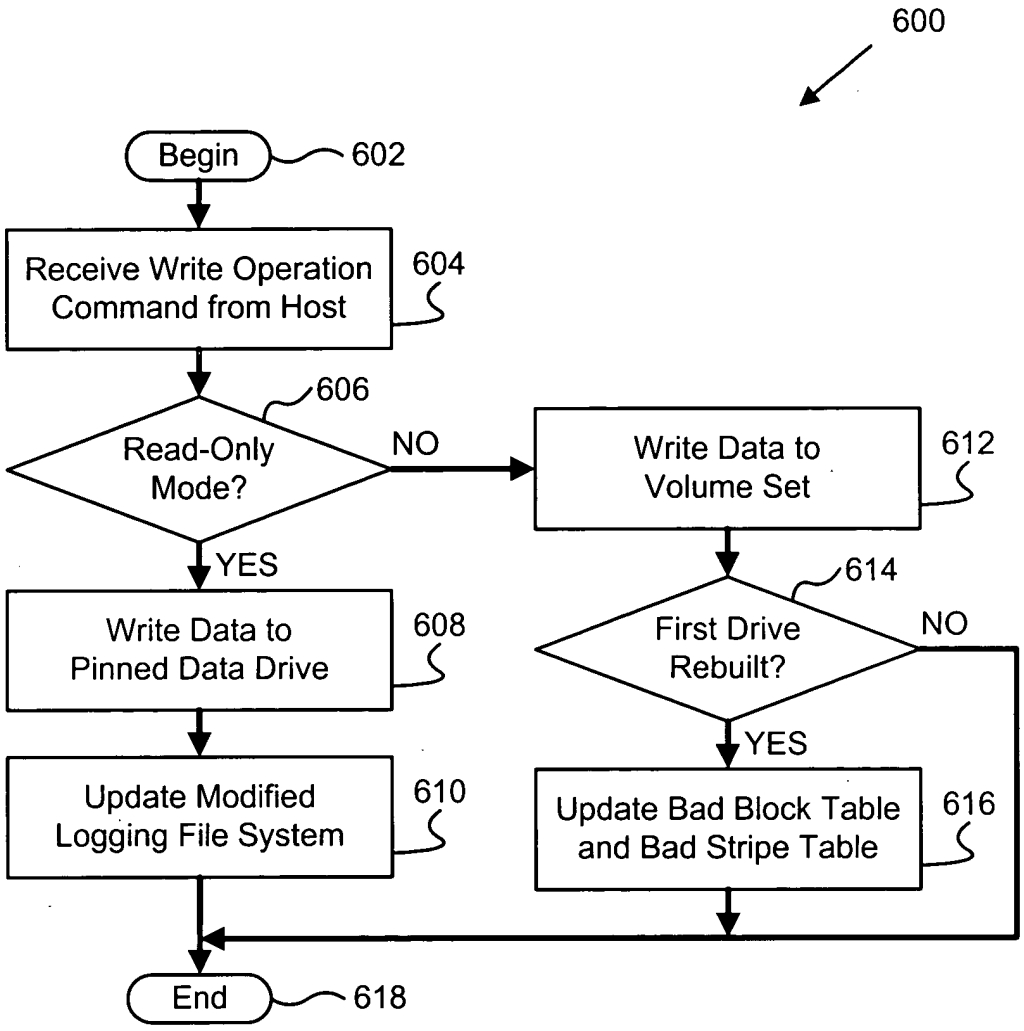
600
Begin
602
Receive Write Operation Command from Host
604
606
Read-Only Mode?
NO
Write Data to Volume Set
612
YES
614
Write Data to Pinned Data Drive
608
First Drive Rebuilt?
NO
YES
Update Modified Logging File System
610
Update Bad Block Table and Bad Stripe Table
616
End
618

FIG. 6

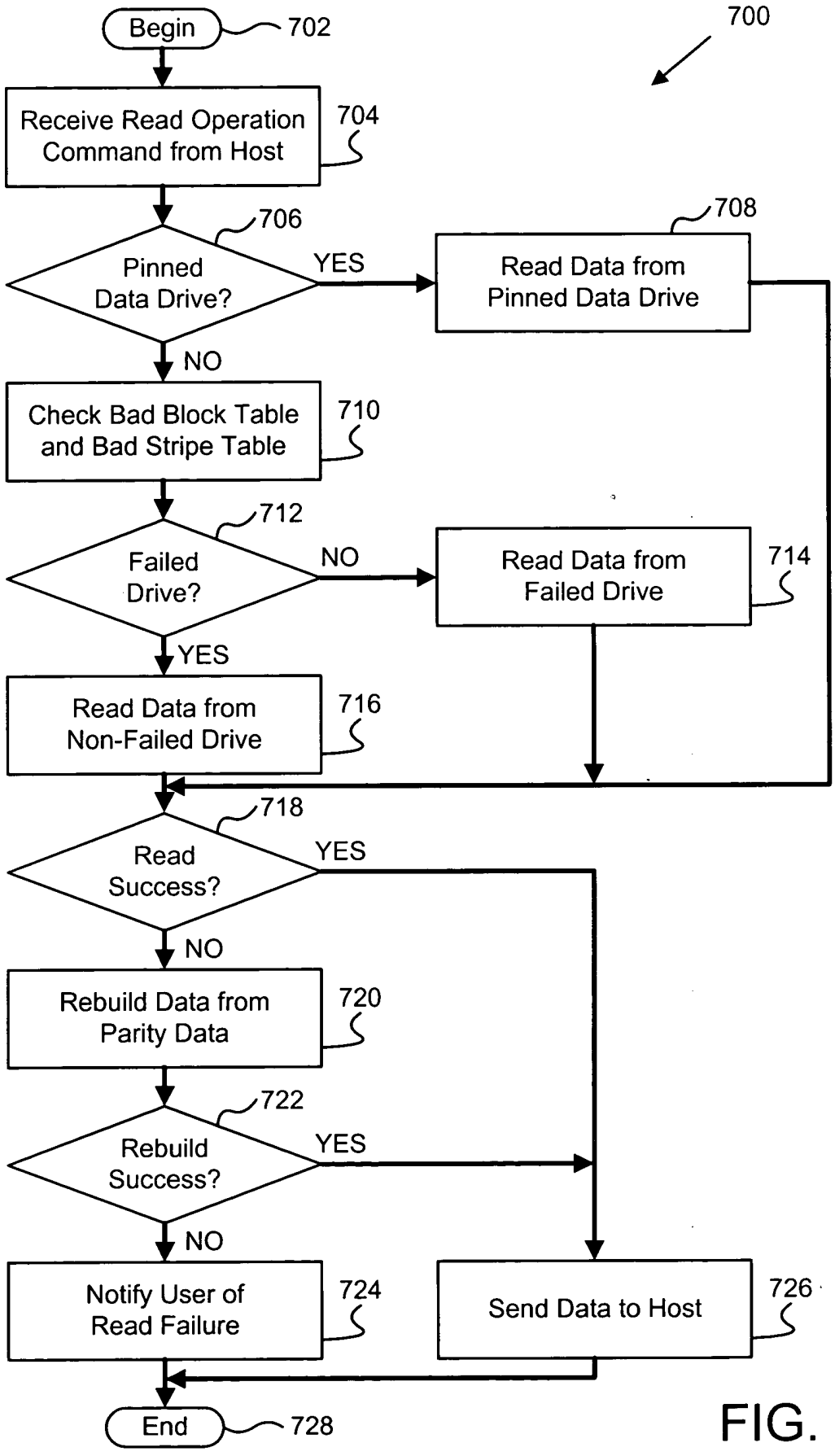
Begin
702
700
Receive Read Operation Command from Host
704
706
Pinned Data Drive?
YES
708
Read Data from Pinned Data Drive
NO
Check Bad Block Table and Bad Stripe Table
710
712
Failed Drive?
NO
Read Data from Failed Drive
714
YES
Read Data from Non-Failed Drive
716
718
Read Success?
YES
NO
Rebuild Data from Parity Data
720
722
Rebuild Success?
YES
NO
Notify User of Read Failure
724
Send Data to Host
726
End
728

FIG. 7